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ARTIFICIAL INTELLIGENCE BASED TECHNIQUE IN DATA MANAGEMENT FOR SMART MANUFACTURING USING INTERNET OF THINGS

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Abstract

The study highlighted the background of the core topic, regarding the Artificial Intelligence (AI) based methods, for the improvement of data management in the case of smart manufacturing through the association of Internet of Things (IoT). Several countries have involved these methods for achieving improvement in decision making, easy surveillance over the working aspects, and other related factors. The research questions and the research objectives were penned down. The performance of thematic analysis allowed the study to highlight the main themes and concepts. The integration of the theory of digital disruption allowed the researcher to associate the main topic with a theoretical approach.

Keywords: Artificial Intelligence, Internet of Things, smart manufacturing, improved efficiency, Cloud computing, Big Data

Introduction

Implementing Artificial Intelligence (AI) has been one of the major elements of digital disruption that has taken over the industrial level. Through the involvement of the Internet of

Things (IoT), various levels of improvement have occurred in both the methods of management and the workings of the employees.

The chapter would highlight the background of the study topic, and jot down the research questions and research objectives.

Background

Through the involvement of Industry revolution 4.0, the techniques of digital transformation and digital; disruption have been achieved at the industrial levels. In the thoughts of Ghosh, Chakraborty & Law (2018), concepts such as the Internet of Things (IoT), Cloud computing, big data analysis, and AI have been necessary for the optimisation of the workload.

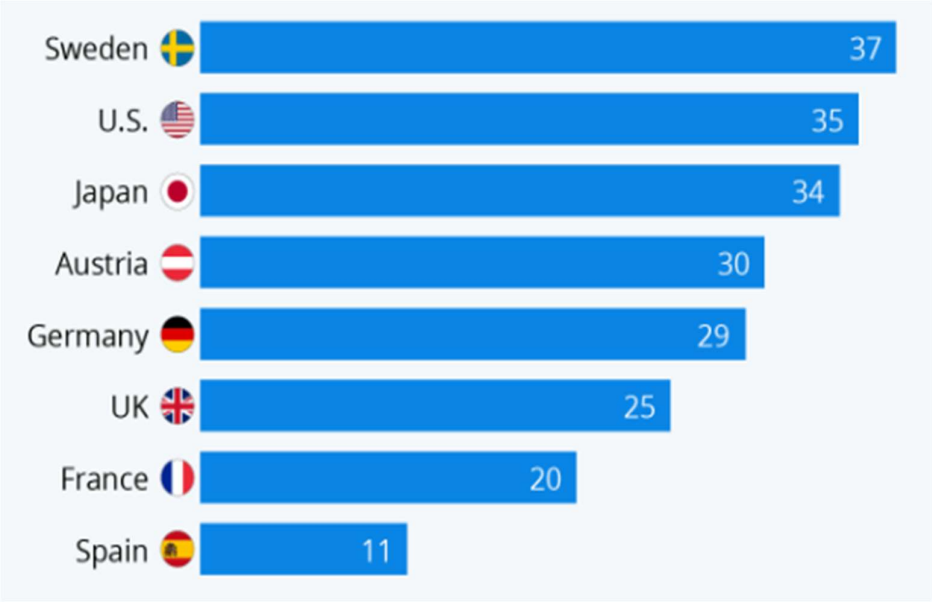

Figure 1: Implementation of IoT in various parts of the world for increasing the productivity

(Source: Statista, 2020)

Figure 1 mentions the countries and the percentages of the inclusion of IoT to increase the productivity of organisations. As seen in the works by Chen *et al.* (2019), through the application of advanced and modern technologies in IoT, smart manufacturing has increased the strictness of inspection in product quality.

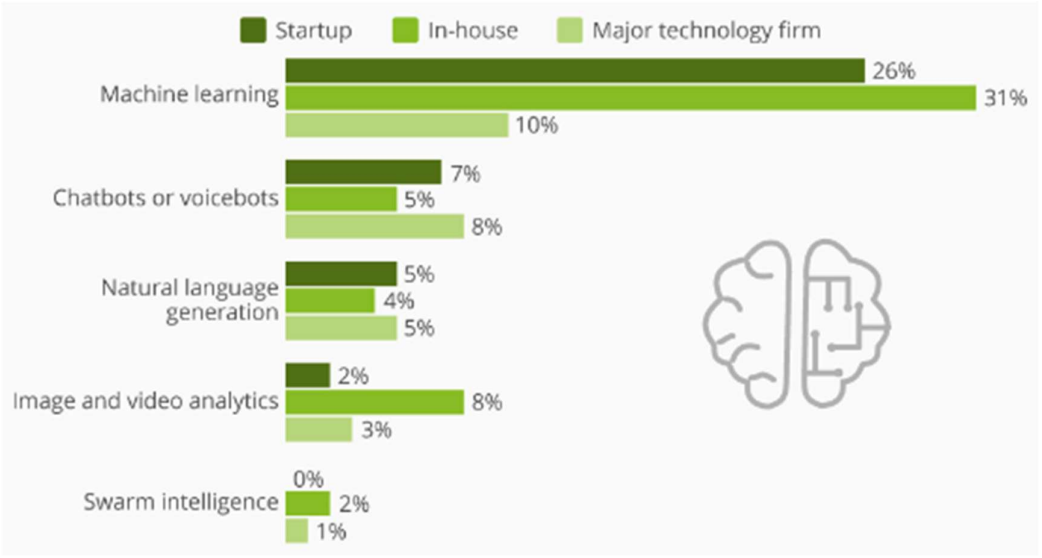

Figure 2: Usage of machine learning in different sectors of the retail industry

(Source: Statista, 2019)

Figure 2 mentions the application of machine learning in data management in the retail and manufacturing sector. As per the thoughts of Tushar *et al.* (2018), the easy gathering of information has caused the hierarchy of the firms to take the necessary decision for further improved efficiencies.

Research objectives

The various research objectives of the study are as follows:

RO1: To examine the factors involved in the application of AI-based techniques in the management of data for smart manufacturing through IoT

RO2: To analyse the benefits achieved due to the implementation of AI-based methods in the data management for smart manufacturing by IoT

RO3: To inspect the strategies for the association of AI-based initiatives in the data management for smart manufacturing with the help of IoT

Research questions

The different research questions of the study are as follows:

RQ1: What are the different factors taken into consideration in the application of AI-based techniques in data management for smart manufacturing by IoT?

RQ2: What are the advantages obtained through the application of AI-based methods in data management for smart manufacturing by IoT?

RQ3: What are the numerous strategies integrated for applying AI-based initiatives in data management for smart manufacturing with the help of IoT?

LITERATURE REVIEW

Introduction

The section based on the literature review would include the different opinions and views of past researchers on the core topic of the study. The involvement of a theoretical approach, through the inclusion of the Theory of Digital Disruption, would also be performed in the segment.

Factors involved in the application of AI-based techniques in the data management for smart manufacturing by IoT

For the accurate integration of AI-based methods into the working rounds of the industries, there is a requirement for the presence of a humongous amount of information. According to the workings of Popescu *et al.* (2021), the quantitative analysis of such data is necessary for laying down future steps for achieving the desired results. On the other hand, as per the views of Hansen & Bøgh (2021), accurate innovation and creativity are needed for the methodical application of the processes.

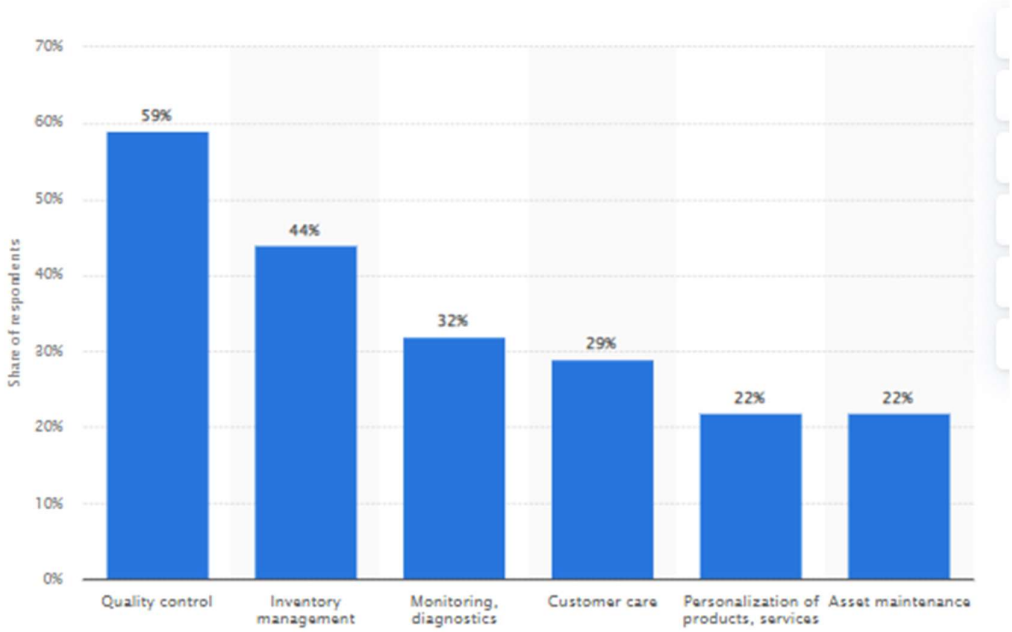

Figure 3: Application of Artificial Intelligence in the manufacturing industry on a worldwide scale

(Source: Statista, 2022)

Figure 3 highlights the different sections of the manufacturing industry where the involvement of AI has been performed. As per the suggestions of Xiong *et al.* (2020), through such manners,

the concept of deep learning evolves and drastically improves the organisational output in the future.

Benefits of AI and IoT for data management in the smart manufacturing

Dramatic improvement in labour efficiency has been seen through the growth of AI and IoT in the working sectors of numerous industries (Statista, 2020). As per the suggestions of M. Bublitz *et al.* (2019), overall quality control of the working methods in various industries has also been seen to be achieved through the integration of AI.

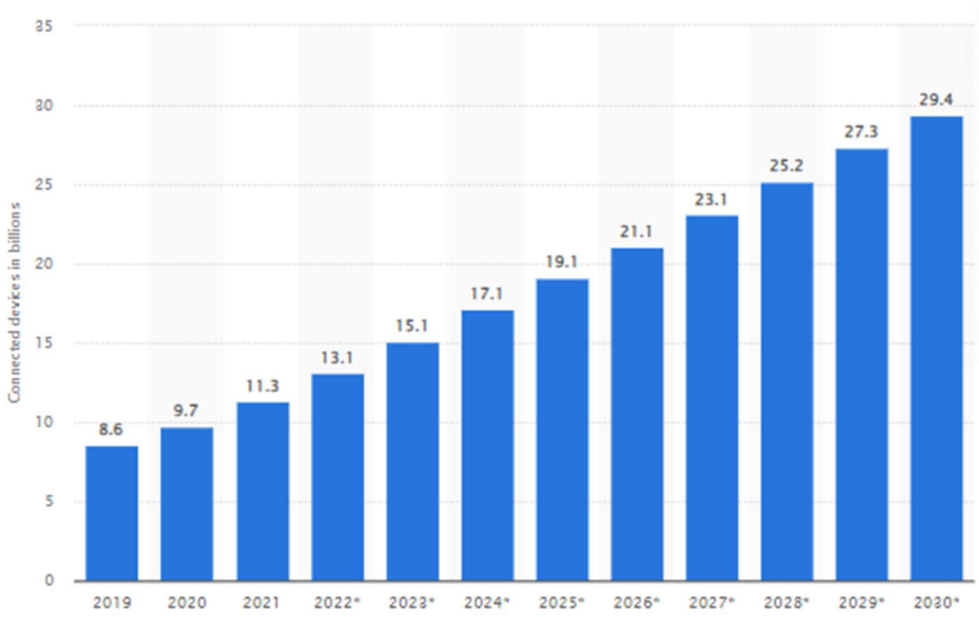

Figure 4: Expansion of IoT in the market through the integration of devices connected worldwide, from 2019 to 2021, and prediction till 2030

(Source: Statista, 2022)

Figure 4 shows the exponential involvement of IoT in the marketing aspects through connected devices on a worldwide scale. As per the comments of Yu *et al.* (2021), the construction of a smart grid further aids the management to have control over the numerous methodologies being involved in the industrial system.

Theoretical approach

Theory of Digital Disruption

Digital innovation has turned out to be a major phenomenon for the growth and expansion of the working efficiency of employees and related industries. The better offering of products and services through an efficient workforce has allowed the firms to further strengthen their elements of competitive advantages. According to the suggestions of Skog, Wimelius & Sandberg (2018), through improved channelling by digital elements, the ***Theory of Digital Disruption*** has increased the assets of the companies.

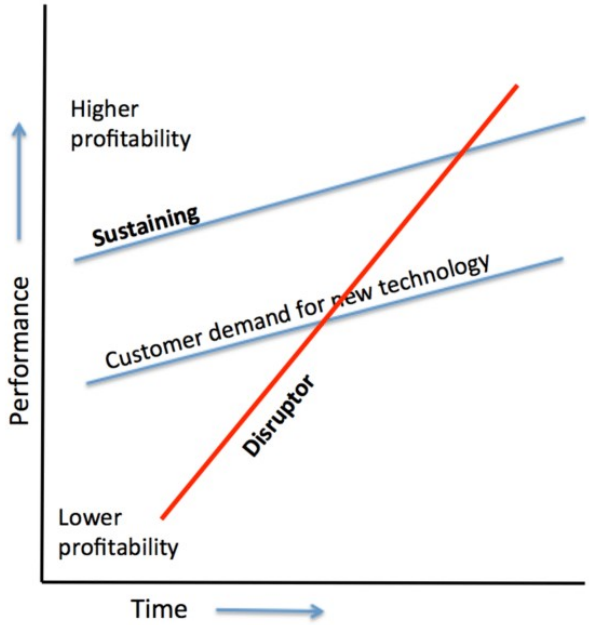

Figure 5: The Disruptive Innovation Model

(Source: Gerber & Matthee, 2019)

Improvement of the business ranking in the platform has been established through the amalgamation of digital theories and scientific techniques. According to the opinions of Sepasgozar *et al.* (2020), smart manufacturing and digital innovation of the marketing elements through AI and IoT have led to the generation of better products and quality of service.

METHODOLOGY

The study has been performed through the implementation of the secondary qualitative research method, where the requisite secondary data have been achieved from secondary data sources. In such a manner, the main topic had been analysed through the opinions of other researchers and authors. The information was sieved from many books, journals, articles, and online websites, and the relevant information was included in the study. The researcher applied the positivism research philosophy for the gathering and examination of the obtained information. Through such a research philosophy, trustworthy and factual information was obtained and examined (Bhatta, 2018). The researcher also applied the descriptive research approach for an elaborate explanation of the elements and associated the explanatory research framework for an in-depth examination of the core factors of the study.

RESULT

Quality review

Authors	Study	Number of	Measuredoutcom	Result	Quality

	design	resources	es		review
Williams, Suler & Vrbka (2020)	Quantitative	12	The application of the Internet of things (IoT) for understanding sustainable smart manufacturing in different IT industries.	The study provided input regarding the implementation of the Internet of things (IoT) into the field of sustainable smart manufacturing in numerous IT firms for observing the relationship between business process optimization, cognitive decision-making algorithms, and others	Moderate
Molaei *et al.* (2020)	Quantitative	14	The relationship found between the concept of artificial intelligence-based decision-making algorithms, with the application of real-time (RT) process monitoring in case of sustainable development	The utilisation of quantitative data for examining the association between data processing in smart manufacturing and the development of business analytics was observed in the study	High
Albreem *et al.* (2021)	Quantitative	17	Assessment of the relationship between the systems of the Internet of Things (IoT), real-time (RT) advanced	The study highlighted the interaction amongst various elements such as IoT, RT advanced analytics, cyber-physical production	Moderate

			analytics, and other elements	networks, and others, in the development of sustainable smart manufacturing	
Wu (2020)	Qualitative	16	Introduction of cloud computing into data management systems through the application of IoT devices	The study mentions the application of cloud computing, Internet of Things (IoT), and Artificial Intelligence (AI) for the data processing approaches in data management and cloud-edge orchestration	Moderate

Table 1: Quality review

(Source: By learner)

Thematic coding

Author	Code	Themes
Williams, Suler & Vrbka (2020) Molaei *et al.* (2020)	Internet of Things, impacts, IoT, data management, smart manufacturing, customer satisfaction, employee retention, Artificial Intelligence, AI	Impact of Artificial Intelligence (AI) on smart manufacturing and data management through the Internet of Things (IoT)

Albreem *et al.* (2021) Wu (2020)	Internet of Things, strategies, IoT, efficient manufacturing, smart manufacturing, Artificial Intelligence, AI	Strategies for the application of the Internet of Things (IoT) for efficient manufacturing through Artificial Intelligence (AI)

Table 2: Thematic coding

(Source: By learner)

Thematic analysis

Theme 1: Impact of Artificial Intelligence (AI) on smart manufacturing and data management through the Internet of Things (IoT)

The concept of smart manufacturing has involved the easy gathering of data and information from a variety of sources within a short period, which can be further assessed quickly. According to the findings by Williams, Suler & Vrbka (2020), through efficient analysis of the achieved information, decision-making processes can be performed quickly, without the presence of manual error. Improvement of the efficiencies of the employees and the managers has been associated with the involvement of IoT, as data management has been made easy. As per the thoughts of Molaei *et al.* (2020), not only has such a concept been necessary for the increased levels of customer satisfaction, but also to retain the employees.

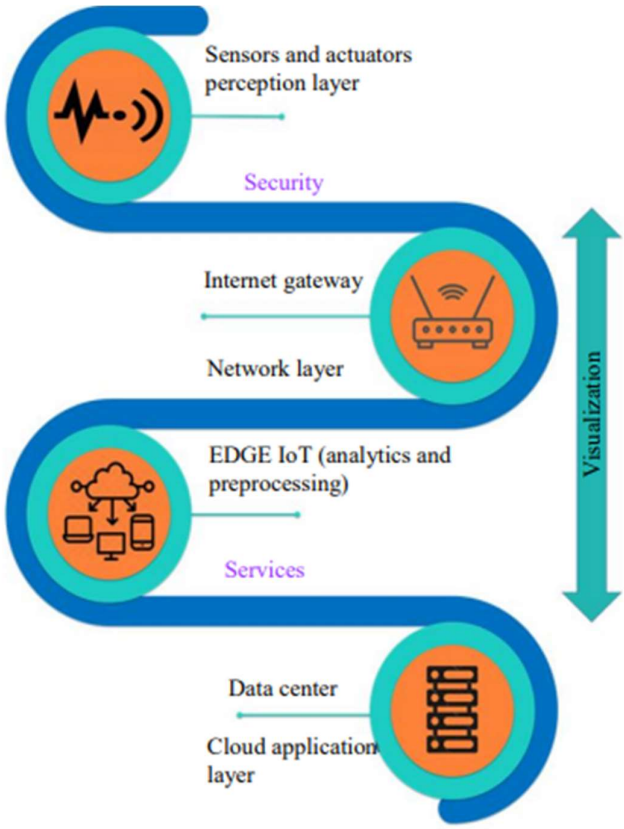

Figure 6: Usage of Artificial Intelligence (AI) in the department of Internet of Things (IoT)

(Source: Molaei *et al.* 2020)

Through IoT and AI, the optimisation of the products at numerous factories has been obtained, where the data from the sensors and machines have allowed the management to take stringent yet achievable decisions. Figure 6 mentions the various methods in steps, along with the features where the application of AI in IoT has improved the working efficiencies of the task force.

Theme 2: Strategies for the application of the Internet of Things (IoT) for efficient manufacturing through Artificial Intelligence (AI)

Cloud computing and intelligent networks have aided the industries to manage the workings of a closed-off working system. As per the views of Albreem *et al.* (2021), risk management has been made easy through the involvement of advanced decision-making through statistical information, and easy steps can be taken the reduction of the negative elements. Smooth communication, informed and methodical steps for management, diminished complexities within the hierarchy, and other steps have been taken through the involvement of IoT and AI.

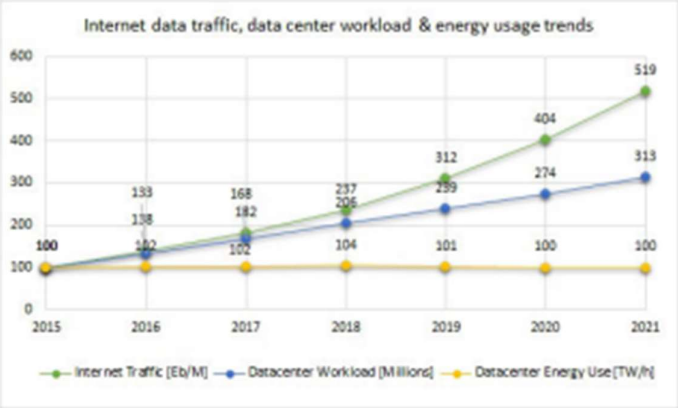

Figure 7: Rise in the usage of data traffic, cloud computing, and energy usage from 2015 to 2021

(Source: Albreem *et al.* 2021)

Efficient levels of manufacturing have been performed with the aid of such digital methods through the analysis of the past data. As per the suggestions of Wu (2020), future steps can be taken with the assessment of past information, as it allows the management to uptake rational decisions. Figure 7 mentions the exponential rise in the implementation of AI that has caused the rise in levels of Internet data traffic, data centre work through cloud computing, and the usage of energy trends. Such factors work as requisite strategies which are integrated into the management levels for improving the levels of efficient manufacturing by AI and IoT.

Discussion

The inclusion of AI has been important for driving the concept of competitive learning, competitive advantage, and growth through the various steps of market paradigms. According to the opinions of Wade & Vochozka (2021), rapid development in smart manufacturing has been achievable through the accurate interpretation and analysis of the related data by the methods of deep learning and artificial neural network (ANN). With the aid of effective decision-making strategies, the rise in the quality of manufacturing and quality control has also been achieved by the firms. Removal of unnecessary processes, complex pathways, and negative factors through the production processes has also been achieved with the help of AI and IoT.

CONCLUSION

Hence, the study contained extensive information regarding the involvement of different elements which have proven to be impactful on the growth of smart manufacturing through AI-based techniques and IoT. The study contained the research questions and objectives, and the application of the secondary qualitative research method was highlighted. Thematic analysis was performed based on the core topic of the study, and a short discussion was drawn based on the obtained information.

Limitations

One of the significant limitations present in the study is the usage of only the secondary qualitative method. In such an aspect, there has been a lack of primary quantitative analysis, which could have integrated the information from the public domain. With the aid of primary quantitative analysis, the main topic of the study could be inspected through the views and opinions of the population.

FUTURE SCOPE

The expansion of AI in the cases of both commercial and personal usage can be observed in the future due to the improvement of the working efficiency of human resources and technologies (Khayyam *et al.* 2020). The study can be further pursued in the future through its proper refinement for further analysing the core topic, and expanding its horizon of implementation.

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